



SAMSUNG DISPLAY



Product Specification

- () Product Information
- () Preliminary Specification
- (☒) Approval Specification

Any modification of Spec is not allowed without SDC's permission

CUSTOMER	G/A Customers	MODEL NO.	LTJ320AP03
DATE OF ISSUE	02/06/2013	EXTENSION CODE	-0

Customer Approval & Feedback	

Approved by	<i>Kang Sang Rae</i> 02/06/2013
Prepared by	<i>Hyun Chang, KANG</i> 02/06/2013
LCD Sales & Marketing Team Samsung Display Co., Ltd	

Table of Contents

REVISION HISTORY	3
GENERAL DESCRIPTION	4
1. ABSOLUTE MAXIMUM RATINGS	
1.1 ENVIRONMENTAL ABSOLUTE RATINGS	6
1.2 ELECTRICAL ABSOLUTE RATINGS	7
2. OPTICAL CHARACTERISTICS	8
3. ELECTRICAL CHARACTERISTICS	
4.1 TFT LCD MODULE	11
4.2 BACK LIGHT UNIT	12
4.3 CONDITION & SPECIFICATION OF INVERTER'S INPUT	12
4. INPUT TERMINAL PIN ASSIGNMENT	
5.1 INPUT SIGNAL & POWER	13
5.2 CONFIGURATION OF INPUT PIN OF INVERTER	15
5.3 THE POWER SEQUENCE FOR INPUTTING TO THE INVERTER	15
5.4 LVDS INTERFACE	16
5.5 INPUT SIGNALS, BASIC DISPLAY COLORS AND GRAY SCALE	17
5. INTERFACE TIMING	
6.1 TIMING PARAMETERS (DE ONLY MODE)	18
6.2 TIMING DIAGRAMS OF INTERFACE SIGNAL (DE ONLY MODE)	19
6.3 CHARACTERISTICS OF INPUT DATA OF LVDS	20
6.4 THE SEQUENCE OF POWER ON AND OFF	22
OUTLINE DIMENSION	23
6. RELIABILITY	25
7. PACKING	26
8. MARKINGS & OTHERS	27
9. GENERAL PRECAUTIONS	28

REVISION HISTORY

Date.	Rev.No.	Page	Revision Description
02/06/2013	P00	all	First issued (Code Change : LTA320AP32-C → LTI320AP03-0)

For GA Only

GENERAL DESCRIPTION

DESCRIPTION

LTI320AP03 uses a liquid crystal display (LCD) that uses amorphous silicon TFT (Thin Film Transistor) as switching components. This model is composed of a TFT LCD panel, a driver circuit, and ass'y KIT of source PBA and BLU (Back light Unit) Ass'y. This 32.0" model has a resolution of 1,366 x 768 pixels (16:9) can display up to 16.7 Million colors with the wide viewing angle of 89° or higher in all directions.

FEATURES

RoHS compliance (Pb-free)
 High contrast ratio & aperture ratio
 PVA (Patterned Vertical Align) mode
 Wide viewing angle ($\pm 178^\circ$)
 High speed response
 HD (1,366 X 768) resolution (16:9)
 Direct U-Type 3 CCFLs (Cold Cathode Fluorescent Lamp)
 DE (Data Enable) mode
 The interface (1 pixel/clock) of LVDS serial interface

CAUTION

Only Landscape
 Must use under 8 hour
 Don't use still image

GENERAL INFORMATION

Items	Specification	Unit	Note
Active Display area	697.6845(H) X 392.256(V)	mm	
Switching Components	a-Si TFT active matrix		
Module Size	760.0(H) x 450.0(V)	mm	Typ
	46.8(D _{MAX})	mm	With inverter
Weight	5,300 (MAX)	g	With inverter
Display colors	16.7M (8bit)	Color	
Number of pixels	1,366 x 768	Pixel	16:9
Pixel Arrangement	RGB Vertical stripe		
Pixel Size	0.51075(H) X 0.51075(V)	mm	
Display Mode	Normally Black		
Surface Treatment	Haze 14% / 3H		
Luminance of White	350(Typ)	cd/m ²	

MECHANICAL INFORMATION

Item		Min.	Typ.	Max.	Unit	Note
Module Size	Horizontal (H)	759	760	761	mm	
	Vertical (V)	449	450	451	mm	
	Depth (D)	-	45.8	46.8	mm	With Inverter
Weight		-	4,300	5,300	g	

For GA Only

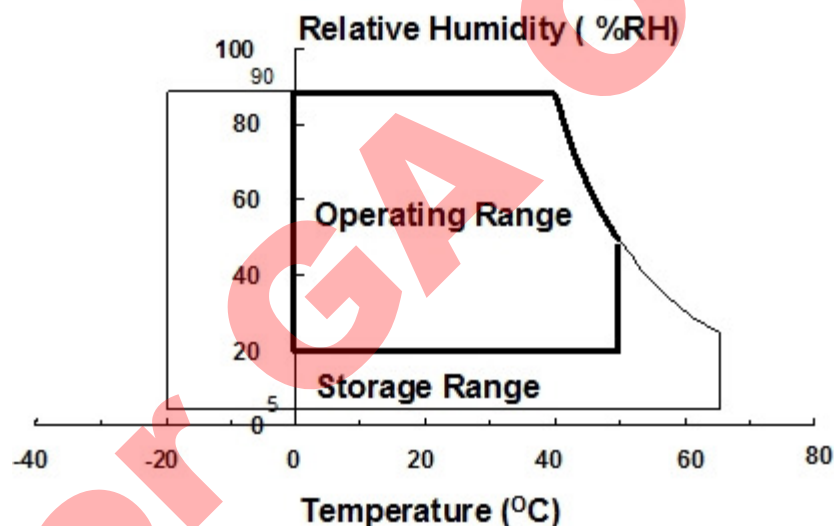
1. ABSOLUTE MAXIMUM RATINGS

1.1 ENVIRONMENTAL ABSOLUTE RATINGS

Item	Symbol	Min.	Max.	Unit	Note
Storage temperature	T_{STG}	-20	65	°C	(1)
Operation Temperature	T_{OPR}	0	50	°C	(1)
	T_{SUR}	0	65	°C	(1), (5)
Shock (non-operating)	$Snop(X,Y,Z)$	-	50	G	(2), (4)
Vibration (non-operating)	V_{nop}	-	1.5	G	(3), (4)

Note (1) Temperature and relative humidity range are shown in the figure below.

- a. 90 % RH Max. ($T_a \leq 39^\circ\text{C}$)
- b. Relative Humidity is 90% or less. ($T_a > 39^\circ\text{C}$)
- c. No condensation



Note (2) 20ms half sine wave, one time for $\pm X$, $\pm Y$, $\pm Z$ axis.

Note (3) 10~300 Hz, Sweep rate 11min, 30min for X,Y,Z axis.

Note (4) The fixture for the test of the vibration and shock, which holds the module to be tested shall be hard and rigid in order for the module not to be twisted or bent by the fixture.

Note (5) Although abnormal visual problems can be occurred in T_{SUR} range, the polarizer is not damaged in this range.

1.2 ELECTRICAL ABSOLUTE RATINGS

(1) TFT LCD MODULE

Item	Symbol	Min.	Max.	Unit	Note
Power Supply Voltage	V _{DD}	10.8	13.2	V	(1)

Note (1) Within Ta (25 ± 2 °C)

(2) BACKLIGHT UNIT

Item	Symbol	Min	Max.	Unit	Note
Input Supply Voltage / Inverter	V _{CC}	-	26.4	V	(1)
Back light On/Off	VBL	-	5.5	V	
Dimming Signal	V _{dim}	-	3.3	V	

Note (1) Within Ta (25 ± 2 °C)

The permanent damage or defect to the device may occur if the panel is operated at the figure set, which exceeds a ceiling of maximum value stated in the former spec. The functional operation should be limited to the conditions described above under normal operating conditions.

2. OPTICAL CHARACTERISTICS

The optical characteristics should be measured in a dark room or the space surrounded by the similar ambient setting.

Measuring equipment : TOPCON RD-80S, SR-3, BM-7, ELDIM EZ-Contrast Ta(25± 2 °C)

Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Note
Contrast Ratio		C/R	-	3000	4000	-	-	(1) SR-3
Response time	G-to-G (AVG)	T _g	-	-	20	30	msec	(3) BM-7
Luminance of White (At the center of screen)		Y _L	-	300	350	-	cd/m ²	(4) SR-3
Color Chromaticity (CIE 1931)	Red	R _X	Normal ϕ = 0 θ = 0 Viewing Angle	TYP. -0.03	0.638	TYP +0.03	-	(5), (6) SR-3
		R _Y			0.326			
	Green	G _X			0.292			
		G _Y			0.608			
	Blue	B _X			0.149			
		B _Y			0.055			
	White	W _X			0.280			
		W _Y			0.290			
Color Gamut		-	-	68	72	-	%	(5) SR-3
Color temperature		-	-	-	10000	-	K	
Viewing Angle	Hor.	θ _L	CR ≥ 10	79	89	-	Degree	(6) EZ-Contrast
		θ _R		79	89	-		
	Ver.	θ _U		79	89	-		
		θ _D		79	89	-		
Brightness Uniformity (9 Point)		B _{uni}	-	-	-	30.0	%	(2) SR-3

* Ta = 25 ± 2 °C, VDD = 3.3V, fv=60Hz, fDCLK = 75MHz,

*Inverter = 57.5(KHz ±2.5KHz), IF =100% duty

Notice (a) Setup for test equipment

The measurement should be executed in a stable, windless and dark room between 40min and 60min after lighting the backlight at the given temperature for stabilization of the backlight. This should be measured in the center of screen.

The environment condition : $T_a = 25 \pm 2 \text{ }^{\circ}\text{C}$

Note (1) Definition of contrast ratio (C/R)

: The Ratio of max. gray (Gmax) & min. gray (Gmin) at the center point ⑤ of the panel.

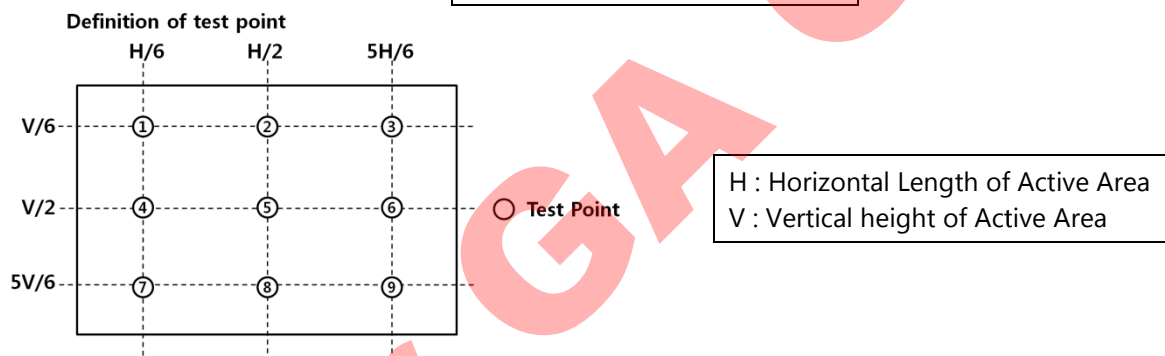
$$C/R = \frac{G_{\max}}{G_{\min}}$$

Gmax : Luminance in all white pixels
Gmin : Luminance in all black pixels.

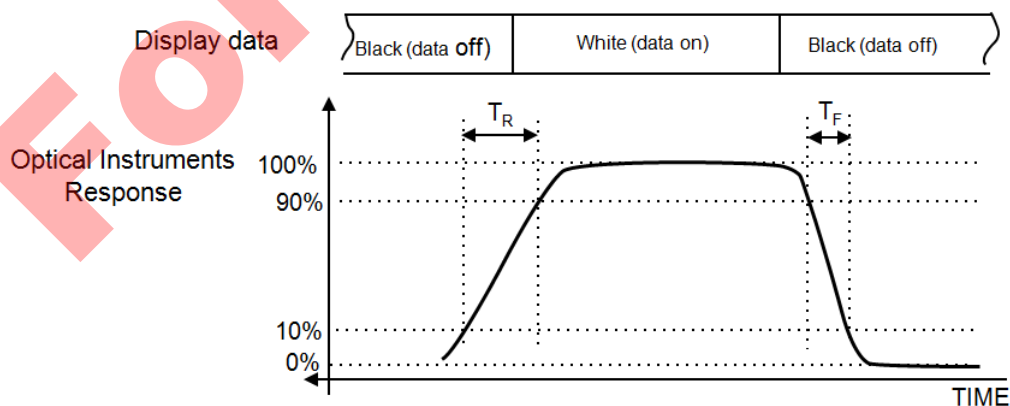
Note (2) Definition of brightness uniformity at 9 points (Test pattern : Full white)

$$B_{uni} = 100 * \frac{(B_{\max} - B_{\min})}{B_{\max}}$$

Bmax : Maximum brightness
Bmin : Minimum brightness



Note (3) Definition of Response time : Sum of T_r , T_f

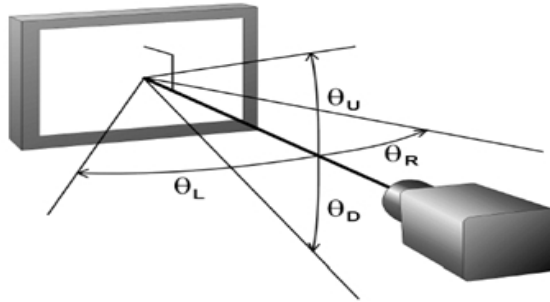


※ G-to-G : Average response time between the whole gray scale to the whole gray scale.

Note (4) Definition of Luminance of White : Luminance of white at center point ⑤

Note (5) Definition of Color Chromaticity (CIE 1931)

Color coordinate of Red, Green, Blue & White at center point ⑤



Note (6) Definition of Viewing Angle : Viewing angle range ($C/R \geq 10$)

For GA Only

3. ELECTRICAL CHARACTERISTICS

3.1 TFT LCD MODULE

The connector to transmit a display data and a timing signal should be connected.

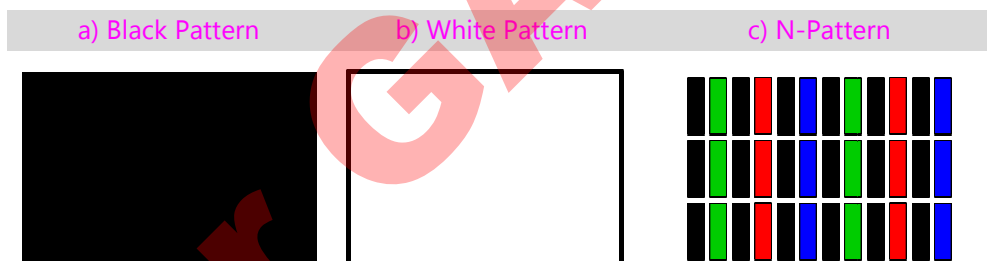
$T_a = 25 \pm 2^\circ\text{C}$

Item	Symbol	Min.	Typ.	Max.	Unit	Note
Voltage of Power Supply	V_{DD}	10.8	12.0	13.2	V	(1)
Current of Power Supply	(a) Black	-	365	830	mA	(2), (3)
	(b) White	-	370	830		
	(c) N-Pattern	-	-	1600		
Vsync Frequency	f_V	48	60	66	Hz	-
Hsync Frequency	f_H	44	48	53	kHz	-
Main Frequency	F_{dclk}	72	78	85	MHz	-
Rush Current	I_{RUSH}	-	-	4	A	(4)

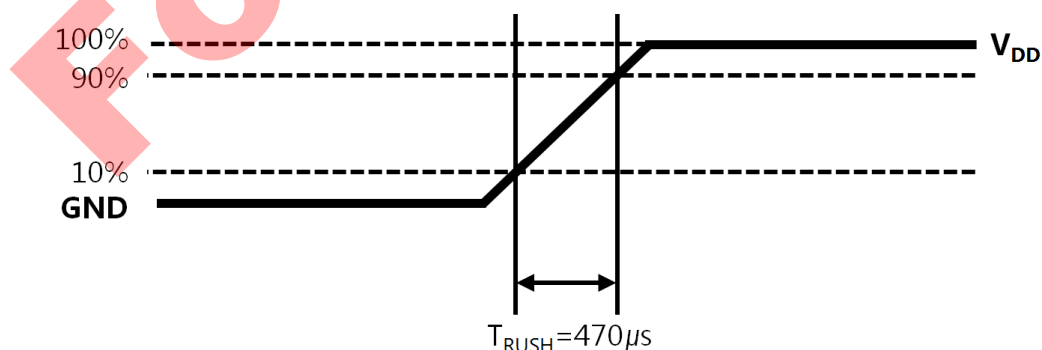
Note (1) The ripple voltage should be controlled under 10% of V_{DD} .

Note (2) $f_V=60\text{Hz}$, $f_{DCLK}=75\text{MHz}$, $V_{DD}=12.0\text{V}$, DC Current.

Note (3) The pattern for checking the power dissipation (LCD module only).



Note (4) Conditions for measurement



The rush current, I_{RUSH} can be measured when T_{RUSH} is $470\mu\text{s}$.

3.2 BACK LIGHT UNIT

Item	Min.	Typ.	Max.	Unit	Note
Operating Life Time	40,000	-	-	Hour	(1)

Note (1) It is defined as the time to take until the brightness reduces to 50% of its original value.
[Operating condition : Ta = 25±2°C]

3.3 CONDITION & SPECIFICATION OF INVERTER'S INPUT

Items	Symbol	Conditions	Specifications			Unit	Note
			Min.	Typ.	Max.		
Input Voltage	V _{in}	-	22	24	26	V	Ta=25±2 °C
Inrush Current	Inrush	V _{in} = 24.0V dim =Max	-	-	4.16	A	Note (2), (3)
Output Current	I _{LED}	V _{in} = 21.6~26.4V dim =Max	18.5	19.5	20.5	mA _{mean}	Note (1)
Inverter On/Off Control	ENA	Enable	3.0	-	5.5	V	-
		Disable	-0.3	-	0.4		
INT_DIM	V _{INT_DIM}	V _{IN} = 24V	0	-	3.3	V	-
	D _{INT_DIM} (Duty)	V _{IN} = 24V V _{INT_DIM} = 3.3V	100	-	-	%	Note (4) V _{INT_DIM} PIN#14 = Floating(N.C.)
		V _{IN} = 24V V _{INT_DIM} = 0V	-	20	-	%	
	F _{INT_DIM}	V _{IN} = 21.6~26.4V Dim = 0V	154	161	168	Hz	Note (5)
EXT_DIM	V _{EXT_DIM}	High Level	3	-	5.25	V	Note (4) V _{INT_DIM} PIN#13 = Floating(N.C.)
		Low Level	-0.3	-	0.4		
	D _{EXT_DIM} (Duty)	V _{in} = 21.6~26.4V	20	-	100	%	Note(5)
	F _{EXT_DIM}		154	161	168	Hz	

Note (1) All data was approved after running 120 minutes.

(2) Inrush is measured within BLU on 10ms after leaving the BLU as it is at least 1hr or more at room temperature(25°C)

(3) Additional Appendix for Input current at room temperature (25 °C)

(4) Internal PWM mode and External PWM mode are not available at the same time. In other word, If one of the dimming control signal was input (connected), the other dimming control signal must be floating (No Connection)

(5) External PWM Frequency should be synchronized with SET Vsync Frequency.

Items	Symbol	Conditions	Specifications			Unit	Note
			Min.	Typ	Max.		
Input Current (Normal Mode)	Iovershoot	V _{in} =24V, Dim=Max	-	3.08	3.28	A _{mean}	Overshoot Current After Turn-on
	Isaturation		-	2.87	3.06	A _{mean}	Saturation current after 1hr aging

4. INPUT TERMINAL PIN ASSIGNMENT

4.1 INPUT SIGNAL & POWER

Connector : IS100-L300-C23(UJU, In-PCB Type)

PIN No.	Description	PIN No.	Description
1	V _{DD} (12V)	16	LV1_P
2	V _{DD} (12V)	17	GND
3	V _{DD} (12V)	18	LV2_N
4	V _{DD} (12V)	19	LV2_P
5	N.C. *(1)	20	GND
6	N.C. *(1)	21	LVCLK_N
7	GND	22	LVCLK_P
8	GND	23	GND
9	LVDS_SEL *(2)	24	LV3_N
10	N.C. *(1)	25	LV3_P
11	GND	26	GND
12	LV0_N	27	N.C. *(1)
13	LV0_P	28	N.C. *(1)
14	GND	29	N.C. *(1)
15	LV1_N	30	GND

Note (1) No Connection : These pins are only used for SAMSUNG internal purpose.

Note (2) LVDS Option : High(3.3V) → Normal NS LVDS format

Low(GND or N.C) → JEIDA LVDS format

Sequence : On = V_{DD}(T1) ≥ LVDS Option ≥ Interface Signal(T2)

Off = Interface Signal(T3) ≥ LVDS Option ≥ V_{DD}

Note (3) LVDS Connector

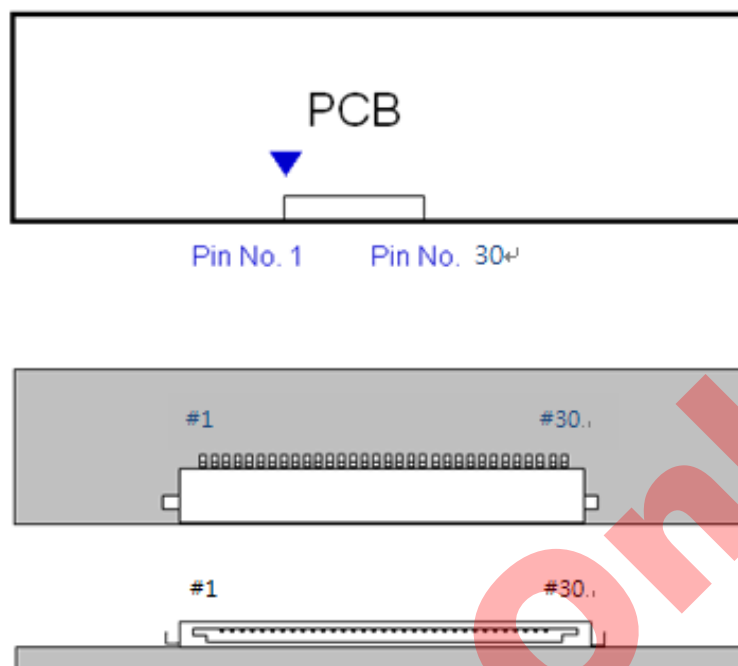


Fig. The diagram of connector .

- Pins for power GND shall be connected to the LCD's metal chassis.
- All input pins for power shall be connected together.
- All NC pins shall be designed with being separated from other signal or power.

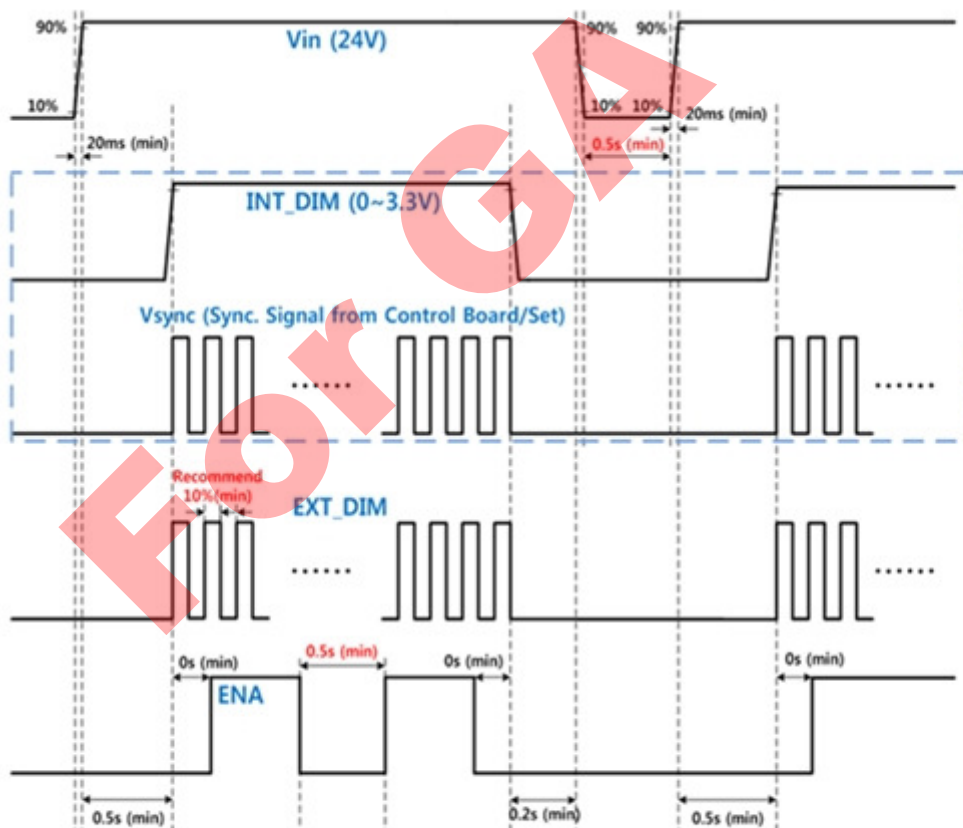
4.2 CONFIGURATION OF INPUT PIN OF INVERTER

Input Connector Model No. : 22022WR-H14B2 (YEONHO)

Pin No.	SYMBOL	Pin Configuration(FUNCTION)
1, 2, 3, 4, 5	Vin	Power Supply DC 24V
6, 7, 8, 9, 10	GND	Ground
11	STATUS	Error_out (normal : GND, abnormal : open collector)
12	ENA	Inverter on/off Control signal
13	INT_DIM	Internal Dimming Control Signal [0V : Min, 3.3V : Max] No Connection (In case of using EXT_DIM #14)
14	EXT_DIM	External Dimming Control Signal No Connection (In case of using INT_DIM #13)

Note) If use Internal Dimming Control, Pin 14 Must be N.C.(No Connection)
If use External PWM, Pin 13 Must be N.C.(No Connection)

4.3 THE POWER SEQUENCE FOR INPUTTING TO THE INVERTER



Internal PWM mode and External PWM mode are not available at same time
In other word, if one of the dimming control signal was input (connected), the other dimming control signal must be floating (No Connection).

4.4 LVDS INTERFACE

- LVDS Receiver : Tcon(Merged)
- Data Format (JEIDA & Normal)

Default LVDS Option : JEIDA

LVDS OPTION(input : pin9) : IF THIS PIN : LOW (GND or N/C) → JEIDA LVDS FORMAT
OTHERWISE : HIGH (3.3V) → NORMAL NS LVDS FORMAT

	LVDS pin	JEIDA -DATA	VESA -DATA
TxOUT/RxIN0	TxIN/RxOUT0	R2	R0
	TxIN/RxOUT1	R3	R1
	TxIN/RxOUT2	R4	R2
	TxIN/RxOUT3	R5	R3
	TxIN/RxOUT4	R6	R4
	TxIN/RxOUT6	R7	R5
	TxIN/RxOUT7	G2	G0
TxOUT/RxIN1	TxIN/RxOUT8	G3	G1
	TxIN/RxOUT9	G4	G2
	TxIN/RxOUT12	G5	G3
	TxIN/RxOUT13	G6	G4
	TxIN/RxOUT14	G7	G5
	TxIN/RxOUT15	B2	B0
	TxIN/RxOUT18	B3	B1
TxOUT/RxIN2	TxIN/RxOUT19	B4	B2
	TxIN/RxOUT20	B5	B3
	TxIN/RxOUT21	B6	B4
	TxIN/RxOUT22	B7	B5
	TxIN/RxOUT24	HSYNC	HSYNC
	TxIN/RxOUT25	VSNC	VSNC
	TxIN/RxOUT26	DEN	DEN
TxOUT/RxIN3	TxIN/RxOUT27	R0	R6
	TxIN/RxOUT5	R1	R7
	TxIN/RxOUT10	G0	G6
	TxIN/RxOUT11	G1	G7
	TxIN/RxOUT16	B0	B6
	TxIN/RxOUT17	B1	B7
	TxIN/RxOUT23	RESERVED	RESERVED

4.5 INPUT SIGNALS, BASIC DISPLAY COLORS AND GRAY SCALE

COLOR	DISPLAY (8bit)	DATA SIGNAL																												GRAY SCALE LEVEL
		RED									GREEN									BLUE										
		R0	R1	R2	R3	R4	R5	R6	R7	G0	G1	G2	G3	G4	G5	G6	G7	B0	B1	B2	B3	B4	B5	B6	B7					
BASIC COLOR	BLACK	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-		
	BLUE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	-			
	GREEN	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	-			
	CYAN	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	-			
	RED	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-			
	MAGENTA	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	-			
	YELLOW	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	-			
	WHITE	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	-			
GRAY SCALE OF RED	BLACK	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	R0			
	DARK ↑ ↓ LIGHT	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	R1			
		0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	R2			
		:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	R3~ R252			
		:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:					
		1	0	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	R253			
	0	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	R254				
	RED	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	R255			
GRAY SCALE OF GREEN	BLACK	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	G0			
	DARK ↑ ↓ LIGHT	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	G1			
		0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	G2			
		:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	G3~ G252			
		:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:					
		0	0	0	0	0	0	0	0	1	0	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	G253			
	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	G254				
	GREEN	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	G255			
GRAY SCALE OF BLUE	BLACK	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	B0			
	DARK ↑ ↓ LIGHT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	B1			
		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	B2			
		:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	B3~ B252			
		:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:					
		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	1	1	1	1	1	B253			
	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	B254				
	BLUE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	B255			

Note) Definition of Gray

Rn : Red Gray, Gn : Green Gray, Bn : Blue Gray(n = Gray Level)

Input Signal : 0 = Low Level Voltage, 1 = High Level Voltage

5. INTERFACE TIMING

5.1 TIMING PARAMETERS (DE ONLY MODE)

SIGNAL	ITEM	SYMBOL	MIN.	TYP.	MAX.	Unit	NOTE
Clock	Frequency	$1/T_C$	72	78	85	MHz	-
Hsync		F_H	44	48	53	KHz	-
Vsync		F_V	48	60	66	Hz	-
Term for the vertical display	Active display period	T_{VD}	-	768	-	Lines	-
	Total vertical	T_V	780	802	1200	Lines	-
Term for the horizontal display	Active display period	T_{HD}	-	1366	-	Clocks	-
	Total Horizontal	T_H	1460	1624	2000	clocks	-

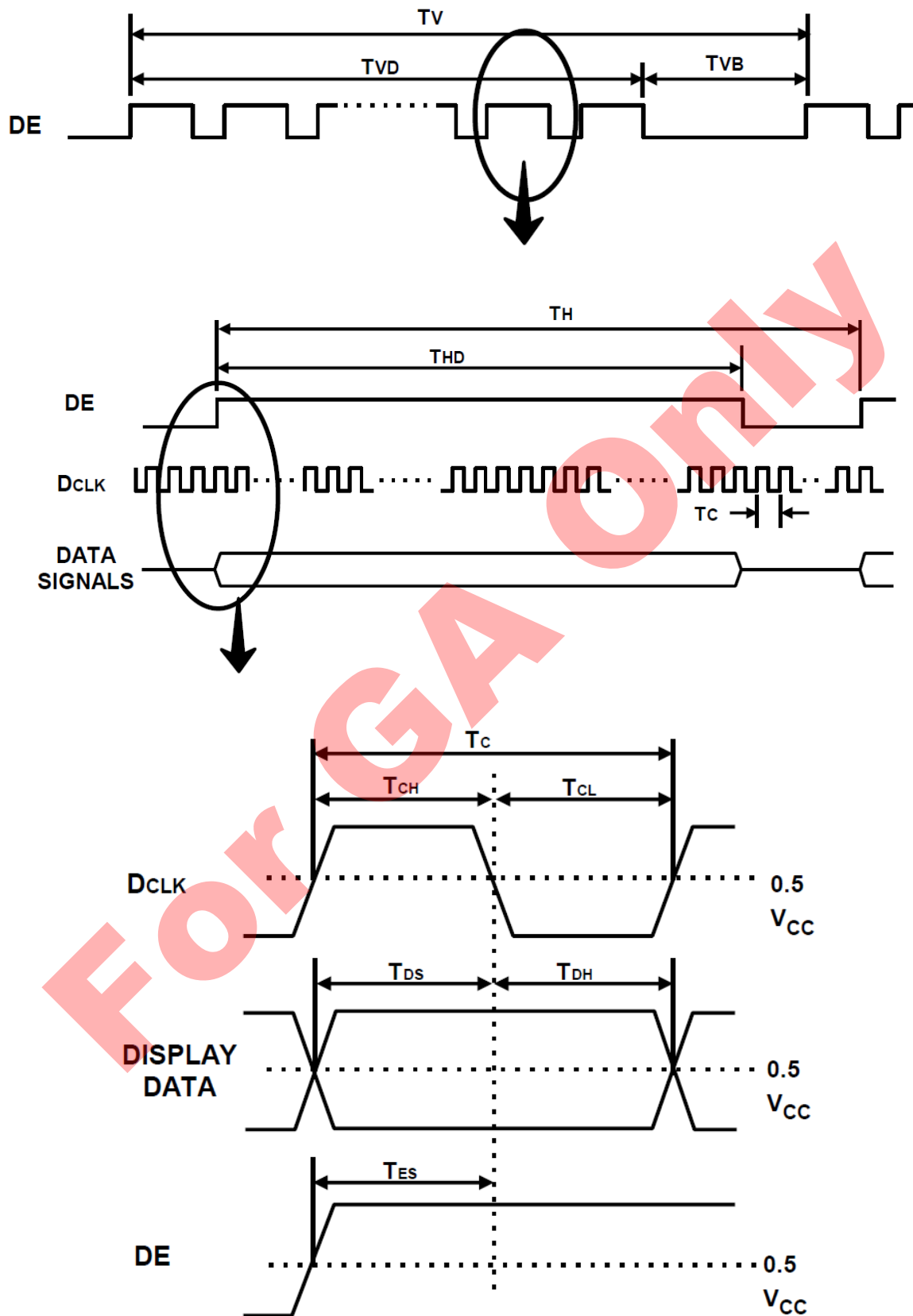
Note) This product is DE only mode.

The signals of Hsync and Vsync does not have an effect on normal operation.

(1) Test Point: TTL controls signal and CLK at LVDS Tx at the input terminal of system.

(2) Internal VDD = 3.3V

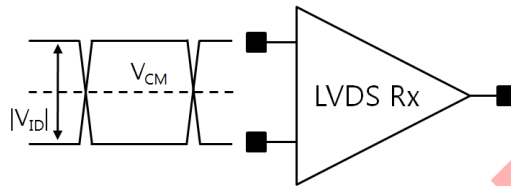
5.2 TIMING DIAGRAMS OF INTERFACE SIGNAL (DE ONLY MODE)



5.3 CHARACTERISTICS OF INPUT DATA OF LVDS

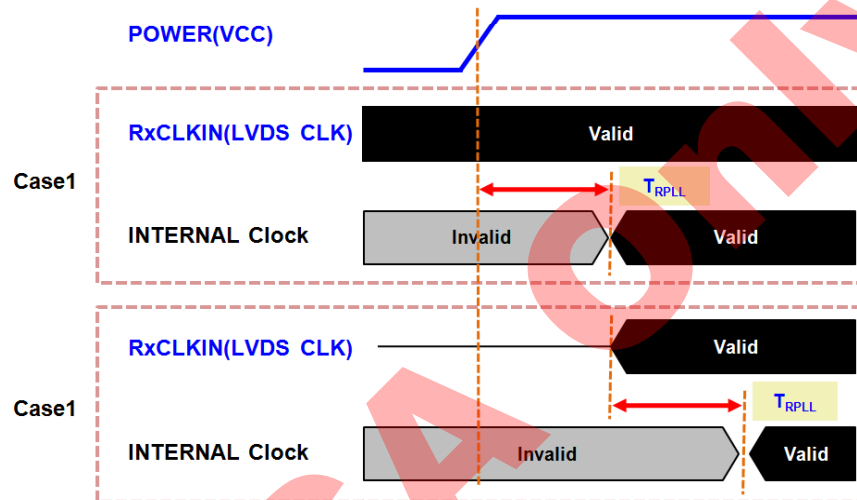
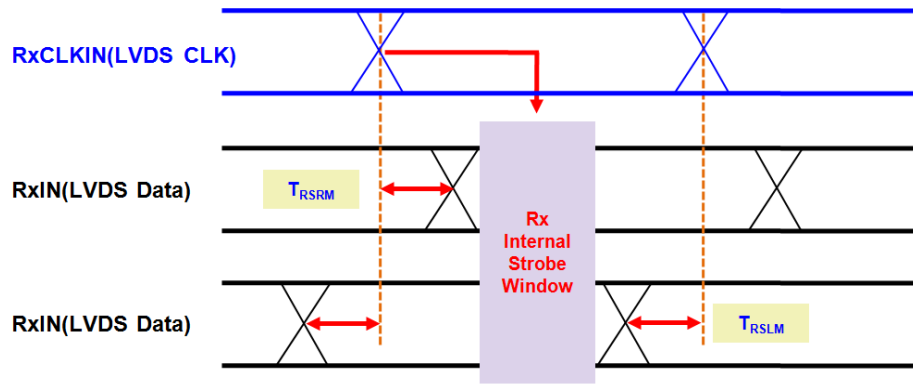
(1) Specification for DC

ITEM	SYMBOL	Min.	Typ.	Max.	UNIT
Supply voltage for IO	VDD33_LVDS	3.0	3.3	3.6	V
Supply voltage in the core	VDD12_LVDS	1.1	1.2	1.3	V
Color depth			8		Bit
Input voltage at the common mode	V_{CM}	0.3		1.8	V
Input voltage for differential	$ V_{ID} $	100	350	600	mV

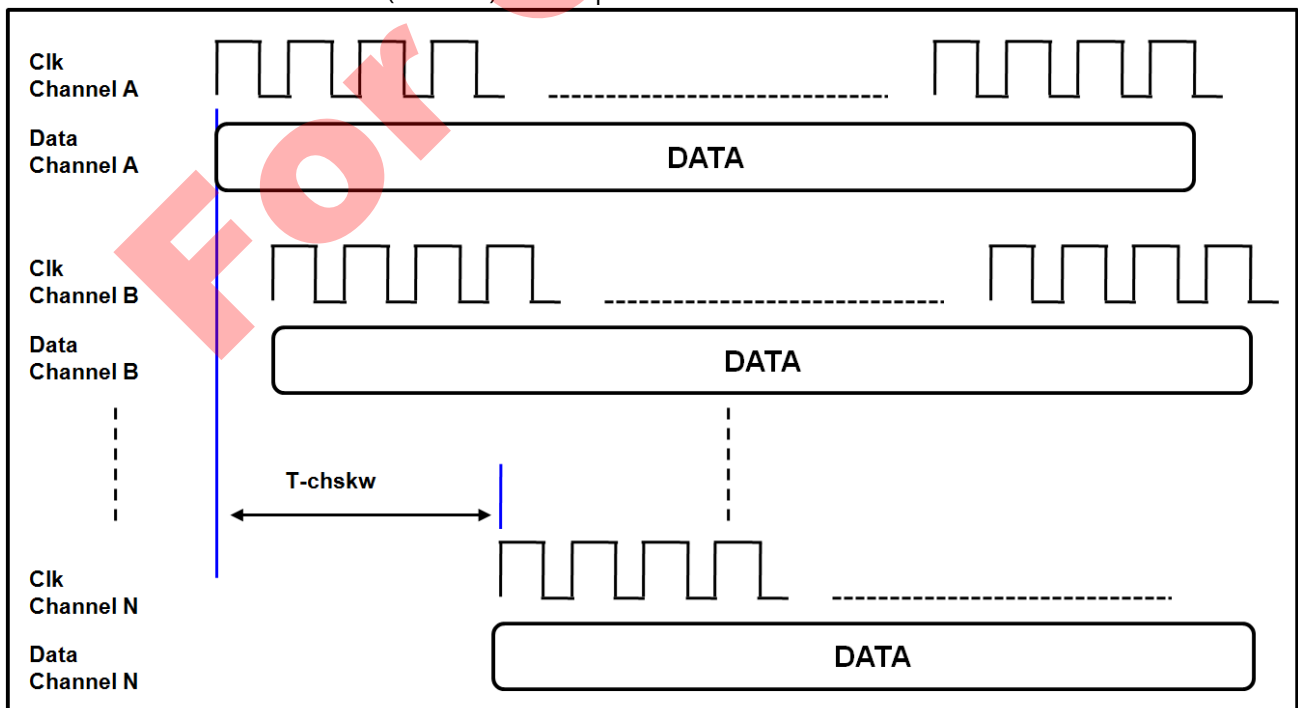


(2) Specification for AC

ITEM		SYMBOL	Min.	Typ.	Max.	UNIT
Frequency for input clock (=1/T)		FIN	55	75	85	MHz
Period of output clock		t_{RCP}	11.11	-	40	ns
Position of input data	FIN=85MHZ	t_{RSRM}	-	-	+400	ps
	FIN=78MHZ		-	-	+450	
	FIN=75MHZ		-	-	+500	
Position of input data	FIN=85MHZ	t_{RSLM}	-400	-	-	ps
	FIN=78MHZ		-450	-	-	
	FIN=75MHZ		-500	-	-	
Lock time		t_{RPLL}	-	-	100	usec
Duty ratio of Rx's clock for output		T_{duty}	45	50	55	%



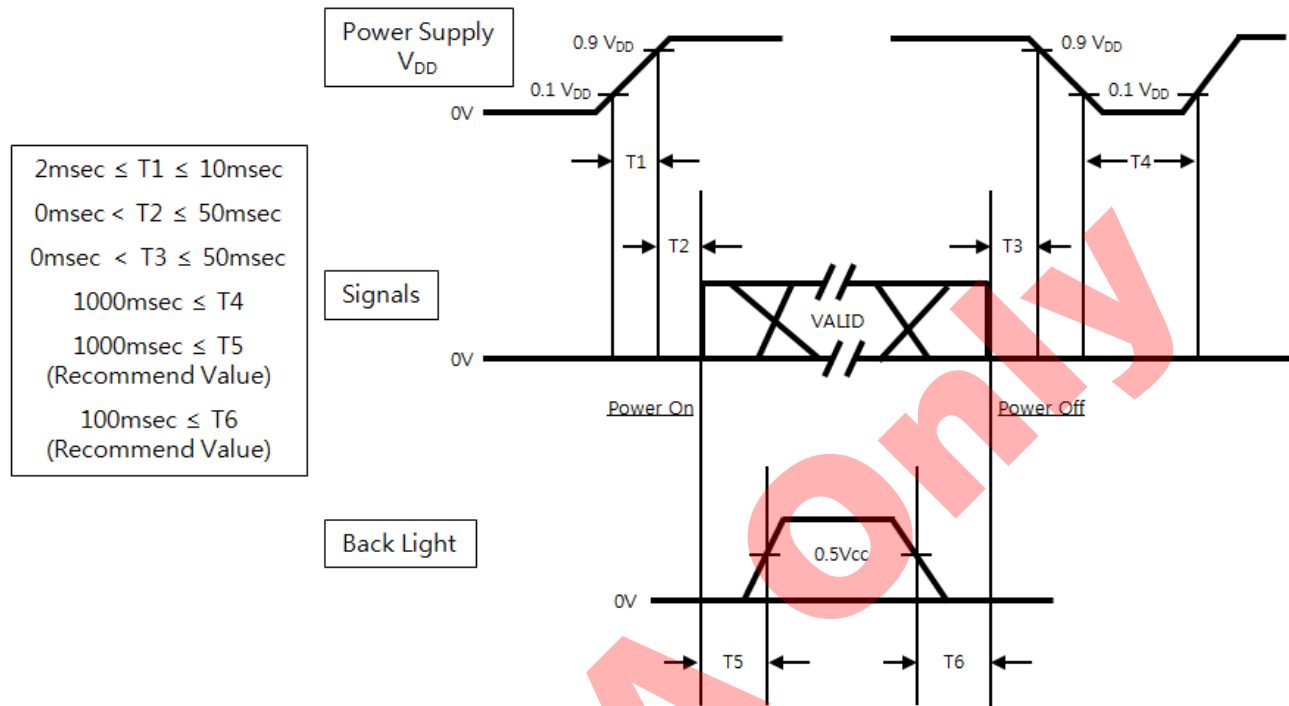
* LVDS Channel to Channel Skew(T_{chskw}) in Multiple LVDS Channels



Note : DE should be synchronized with DE per each LVDS Channel and $T_{chskw} < 16 \times \text{LVDS Clock Period}$

5.4 THE SEQUENCE OF POWER ON AND OFF

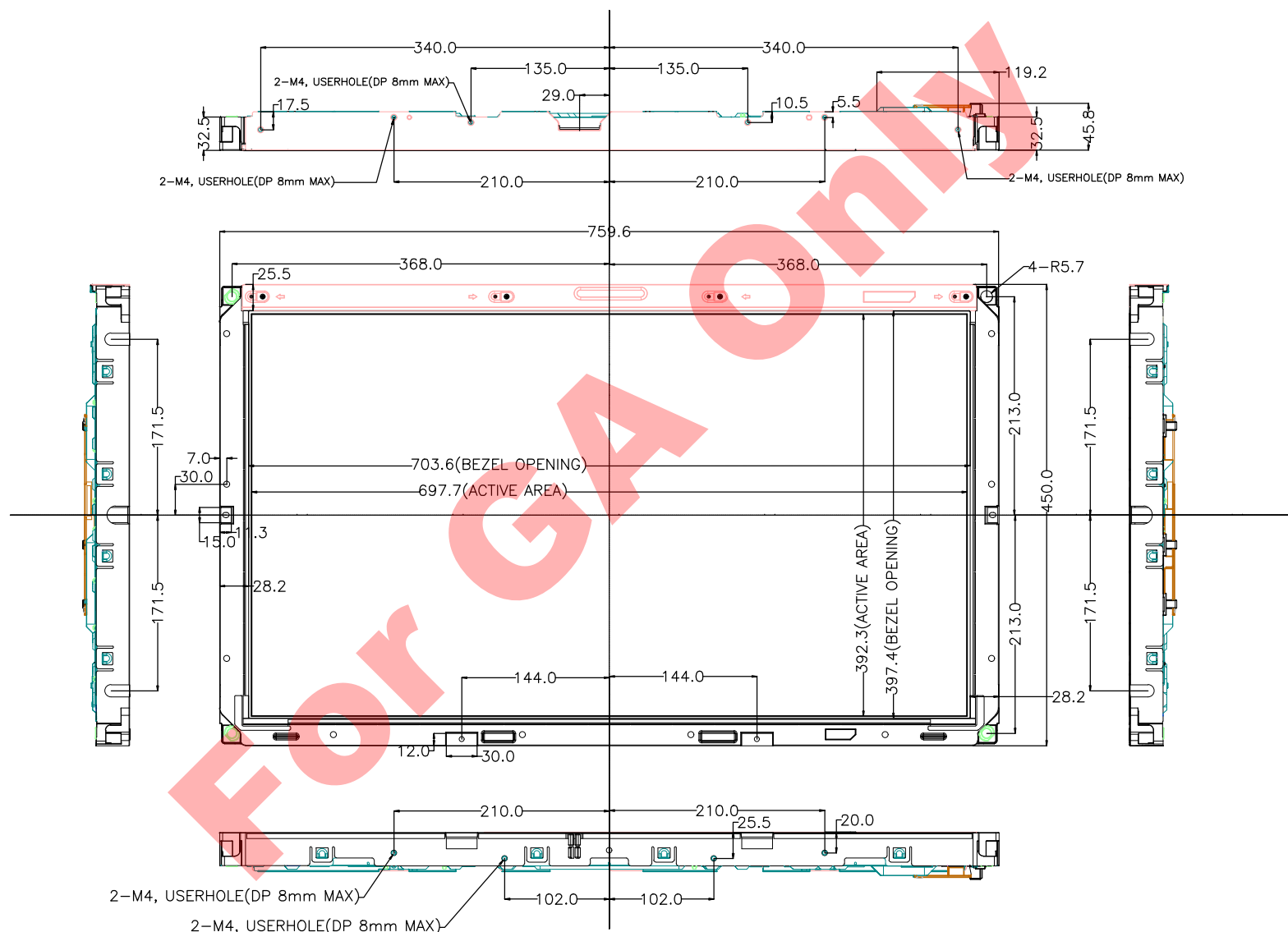
To prevent the product from being latched up or the DC in the LCD module from starting an operation, the order to turn the power on and off should be changed to the order as shown in the diagram below.



Timing	Remarks
T_1	The time, during which the level of V_{DD} is rising from 10% to 90%.
T_2	The change for time, during which the V_{DD} starts rising beyond 90% until the valid data of signal started coming in.
T_3	The change for time, during which the valid data of signal starts leaving out until the V_{DD} starts falling below 90%.
T_4	The time, during which the V_{DD} starts falling below 10% to restart the Windows.
T_5	The time, during which the signal of BLU starts rising beyond 50%.
T_6	The time, during which the signal of BLU starts falling below 50%.

- The inputted V_{DD} 's value for supply voltage, BLU, and signal to the external system of the module shall be computed with referring to the former mentioned value.
- The method to apply the voltage to the lamp within the range, which the LCD operates. When the back-light is turned on before the LCD is operated or the power of LCD is turned off before the back-light is turned off, the abnormal display on the screen may be shown momentarily.
- Please keep the level of input signal low or keep the level of impedance high when the value of V_{DD} is below 10%.
- The value shall be measured after the module has been fully discharged between the period, which the power is turned on and the period, which the power is turned off like the T_4 timing. The backlight may be flashed if the interface signal remains floated when the above-mentioned signal becomes invalid.

NO	PART NAME	CODE NO	SPECIFICATION	QTY	SPEC NO	REMARK
1	OUTLINE DIMENSION	-	LTJ320AP03-0	1		



GENERAL TOLERANCE				REV	DATE	DESCRIPTION OF REVISION			REASON		CHK'D BY
DISTANCE	LEVEL 1	LEVEL 2	LEVEL 3	UNIT	mm	SCALE	DRAWN BY	DES'D BY	CHK'D BY	APP'D BY	
0 < X ≤ 6	± 0.05	± 0.1	± 0.3								
6 < X ≤ 30	± 0.1	± 0.2	± 0.5								
30 < X ≤ 120	± 0.15	± 0.3	± 0.8								
120 < X ≤ 400	± 0.2	± 0.5	± 1.2								
400 < X ≤ 1000	± 0.3	± 0.8	± 2.0								

SAMSUNG DISPLAY

MODEL NAME
LTJ320AP03-0

PART/SHEET NAME
OUTLINE DIM.(FRONT)

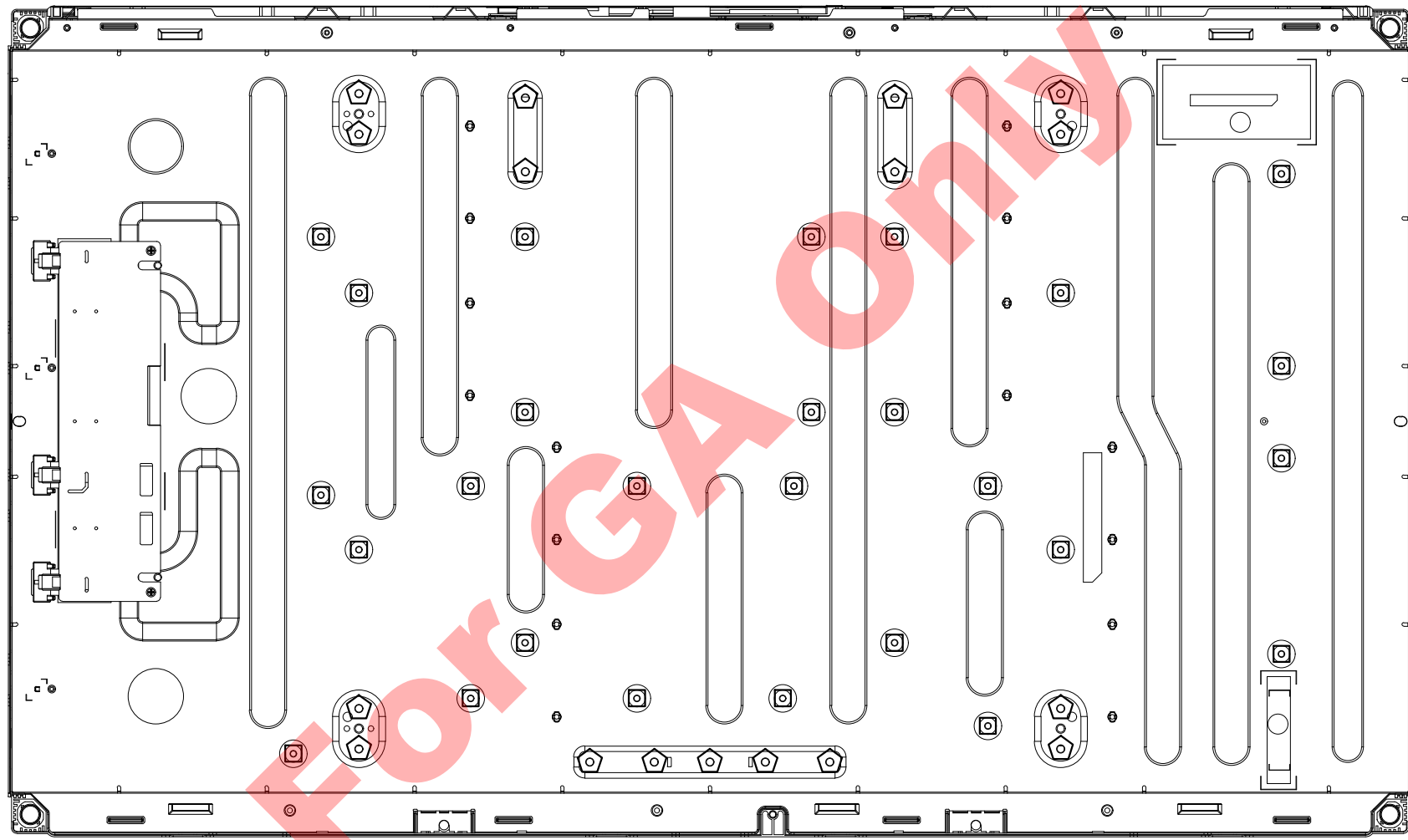
SHEET 1/2

SPEC. NO.

CODE NO.

VER. 001

NO	PART NAME	CODE NO	SPECIFICATION	QTY	SPEC NO	REMARK
1	OUTLINE DIMENSION	-	LT1320AP03-0	1		



Userhole Distance from Datum Point : $X < 400 : \pm 0.5$, $400 \leq X : \pm 0.8$

□ M3 ▢ M4 ▢ M6

NO. 1320AP03-0

GENERAL TOLERANCE				REV.		DATE		DESCRIPTION OF REVISION			REASON		CHK'D BY	
DISTANCE	LEVEL 1	LEVEL 2	LEVEL 3	UNIT	mm	DRWN BY	DES'D BY	CHK'D BY	APP'D BY	MODEL NAME	LT1320AP03-0		SHEET	2/2
0 < x ≤ 6	± 0.05	± 0.1	± 0.3	SCALE			Y.B.M			PART / SHEET NAME	OUTLINE DIM.(BACK)		VER.	001
6 < x ≤ 30	± 0.1	± 0.2	± 0.5	TOLERANCE			13.02.05							
30 < x ≤ 120	± 0.15	± 0.3	± 0.8	LEVEL 3										
120 < x ≤ 400	± 0.2	± 0.5	± 1.2	SAMSUNG DISPLAY										
400 < x ≤ 1000	± 0.3	± 0.8	± 2.0							SPEC. NO.	—			

6. RELIABILITY TEST

Item	Test condition	Quantity
HTOL	50℃, 1000hr determination	8EA
LTOL	0℃, 1000hr determination	4EA
RTOL	25℃, Continuously	4EA
HTS	70℃, 500hr determination	4EA
LTS	-30℃, 500hr determination	4EA
THB	40℃ / 95%RH, 500hr determination	10EA
WHTS	60℃ / 75%RH, 500hr determination	4EA
T/C	-20 ~ 60℃, 200cycle	4EA
Contact ESD	±8 kV, 200Point, 1 time/Point	3EA
Air ESD	±15 kV, 200Point, 1 time/Point	3EA
Input Con. ESD	±10kV, Input Con. Pin, 3 times/Pin	3EA
Power On/Off	30 sec(On) / 30 sec(Off) : 12,000 times	4EA
Vibration	10~300Hz/1.5G/10min SR, XYZ 30min/axis	3EA
Shock	50G, 11msec, ±XYZ 1tims/axis	3EA
Pallet Vibration	1.05Grms, Random, Z axis 1Hr	1Pallet
Pallet Drop	20cm, bottom side 4 angles	1Pallet

[Criteria on evaluation]

The components of product, which may affect to the function of display shall not be changed when the display quality test is executed under the normal operating condition.

* HTOL / LTOL : The operating at the high and low temperature*

* THB : The slant of temperature and humidity

* HTS / LTS : The storage at the high and low temperature

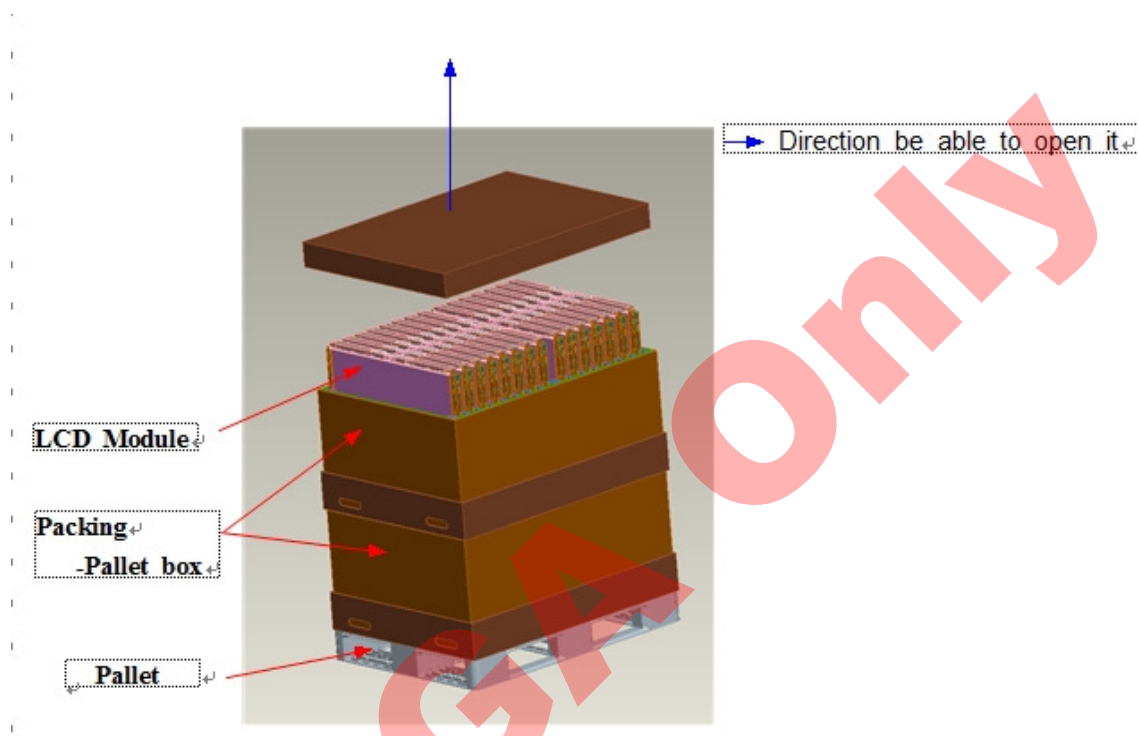
* WHTS : The storage condition at the high temperature with the high humidity

7. PACKING

7.1 CARTON (INTERNAL PACKAGE)

(1) Packing Form : Paper Box

(2) Packing Method



Note(1) Total Weight : Approximately 99.75kg [With Pallet Plastic]

Note(2) Acceptance number of piling : 2 Pallets

Note(3) Carton size : 1137mm(H) x 840mm(V) x 485mm(Height) [With Pallet Plastic]

(3) Packing Material

No	Part name	Quantity
1	Packing-Pallet BOX	2 EA
2	Bag-Shielding	15 EA
3	Protector-Panel	15 EA
4	Pallet-Plastic	1 EA

8. MARKINGS & OTHERS

A nameplate bearing followed by is affixed to a shipped product at the specified location on each product.

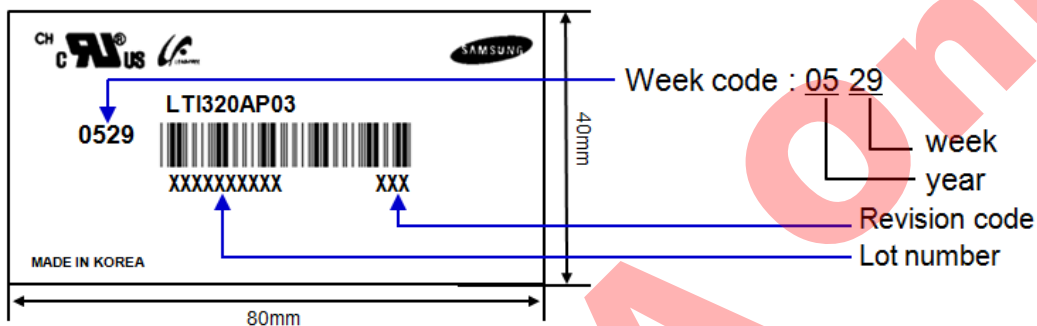
(1) Parts number : LTI320AP03

(2) Revision code : Three letters

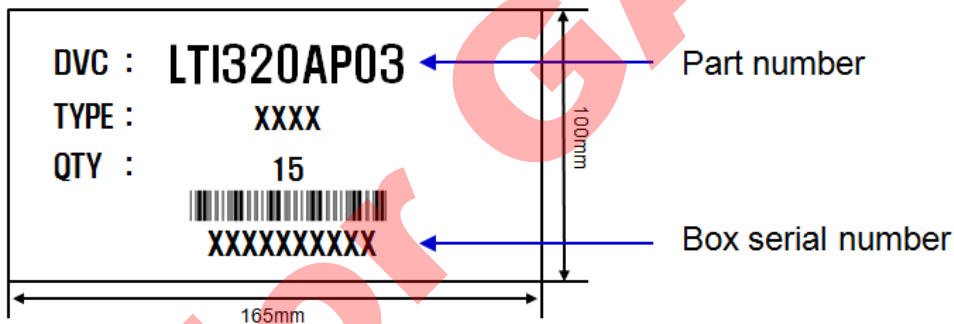
(3) Lot number : X X X X XXX XX X

Cell Position No. (In the Glass)
Glass No. (In the one Lot)
Lot No. (Glass)
Month
Year (Note1)
Product code
Line

(4) Nameplate Indication



(5) Packing small box attach



9. GENERAL PRECAUTIONS

9.1 HANDLING

- (a) When the module is assembled, It should be attached to the system firmly using every mounting holes. Be careful not to twist and bend the modules.
- (b) Refrain from strong mechanical shock and / or any force to the module. In addition to damage, this may cause improper operation or damage to the module and CCFT back-light.
- (c) Note that polarizers are very fragile and could be easily damaged. Do not press or scratch the surface harder than a HB pencil lead.
- (d) Wipe off water droplets or oil immediately. If you leave the droplets for a long time, Staining and discoloration may occur.
- (e) If the surface of the polarizer is dirty, clean it using some absorbent cotton or soft cloth.
- (f) The desirable cleaners are water, IPA (Isoprophyl Alcohol) or Hexane. Do not use Ketone type materials (ex. Acetone), Ethyl alcohol, Toluene, Ethyl acid or Methyl chloride. It might permanent damage to the polarizer due to chemical reaction.
- (g) If the liquid crystal material leaks from the panel, it should be kept away from the eyes or mouth. In case of contact with hands, legs or clothes, it must be washed away thoroughly with soap.
- (h) Protect the module from static. it may cause damage to the C-MOS Gate Array IC.
- (i) Use fingerstalls with soft gloves in order to keep display clean during the incoming inspection and assembly process.
- (j) Do not disassemble the module.
- (k) Do not pull or fold the Lamp wire.
- (l) Do not touch any component which is located on the back side.
- (m) Protection film for polarizer on the module shall be slowly peeled off just before use so that the electrostatic charge can be minimized.
- (n) Pins of I/F connector shall not be touched directly with bare hands.

9.2 STORAGE

We highly recommend to comply with the criteria in the table below.

ITEM	Unit	Min.	Max.
Storage Temperature	(°C)	10	40
Storage Humidity	(%rH)	35	75
Storage Life	6 months		
Storage Condition	<ul style="list-style-type: none"> - The storage room should be equipped with a good ventilation facility, which has a temperature controlling system. - Products should be placed on the pallet, which is away from the wall not on the floor. - Prevent products from being exposed to the direct sunlight, moisture, and water. Be cautious not to pile the products up. - Avoid storing products in the environment, which other hazardous material is placed. - If products are delivered or kept in the storage facility more than 3 months, we recommend you to leave products under the condition including a 20°C temperature and a humidity of 50% for 24 hours. - If you store semi-manufactured products for more than 3 months, bake the products under the condition including the 50°C temp. and the 10% humidity for 24hrs after being used. 		

9.3 OPERATION

- (a) Do not connect or disconnect the cable to/ from the module at the "Power On" condition.
- (b) The power shall be always turned on/off by the item 6.5. "Power on/off sequence"
- (c) The module has a circuit with a high frequency. The system manufacturers shall suppress the electromagnetic interference sufficiently. The methods to ground and shield are important to minimize the interference.
- (d) Design the length of cable to connect between the connector for back-light and the inverter as short as possible and the shorter cable shall be connected directly.
The longer cable between that of back-light and that of inverter may cause the luminance of lamp(CCFL) to lower and need a higher startup voltage(Vs).

9.4 OPERATION CONDITION GUIDE

- (a) The LCD product should be operated under normal conditions.
Normal condition is defined as below;
 - Temperature : 20±15 °C
 - Humidity : 55±20%
 - Display pattern : continually changing pattern (Not stationary)
- (b) If the product will be used in extreme conditions such as high temperature, humidity, display patterns or operation time etc., It is strongly recommended to contact SDC for Application engineering advice.
Otherwise, its reliability and function may not be guaranteed. Extreme conditions are commonly found at Airports, Transit Stations, Banks, Stock market, and Controlling systems.

9.5 OTHERS

- (a) Ultra-violet ray filter is necessary for outdoor operation.
- (b) Module should be turned clockwise (regular front view perspective) when used in portrait mode.
- (c) Avoid condensation of water. It may result in improper operation or disconnection of electrode.
- (d) Do not exceed the absolute maximum rating value. (supply voltage variation, input voltage variation, variation in part contents and environmental temperature, and so on) Otherwise the Module may be damaged.
- (e) If the Module keeps displaying the same pattern for a long period of time, the image may be "sticked" to the screen. To avoid image sticking, it is recommended to use a screen saver.
- (f) This Module has its circuitry PCB's on the rear side and should be handled carefully in order not to be stressed.
- (g) Please contact SDC in advance when you display the same pattern for a long time.